

## CHAPTER IV

### TRAFFIC DEVICES AND STREET ILLUMINATION

#### 410 TRAFFIC SIGNS

Traffic signs shall be furnished and erected in conformance with MUTCD and the Standard Specifications supplemented by the State of Oregon, and/or modified as follows: Modifications to these standards must be approved by the City Engineer or designee.

##### 410.1 MATERIALS

###### Aluminum

Minimum thickness of 0.080 inches shall be used.

###### Plywood

No plywood will be permitted on any sign without prior approval from the City Engineer or designee.

###### Polyplate

The use of polyplate may be used only on 18 x 18-inch or smaller signs with the prior approval of the City Engineer or designee.

###### Sheeting

3M Scotchlite brand high intensity reflective sheeting shall be used as a background, except for **"NO PARKING"** and overhead street name signs where Type II reflective sheeting is allowed.

###### Posts

A minimum of 2 x 2-inch x 10-foot, 14-gauge galvanized "quick-punch" or 12-gauge perforated posts, or approved equivalent, shall be used.

A 2 x 2-inch x 12-foot, 14-gauge galvanized "quick-punch" or 12-gauge perforated posts, or approved equivalent, shall be used when a combination of signs is more than

36 inches in height. Sign post is 2-inch square tubing and must be embedded 12 inches into base.

Round metal posts will not be permitted. Wood posts may be used only with prior approval of the City Engineer or designee and must be configured and drilled for breakaway as per ODOT specifications.

#### Base

The breakaway post base shall consist of a 2.25 x 2.25 inch (I.D.) x 36-inch Galvanized base with a 2.5 x 2.5 inch (I.D.) x 18-inch sleeve placed flush with base. All sleeves and bases shall be 14-gauge "quick-punch" or 12-gauge perforated material, or approved equivalent.

#### Fastening

Drive rivets shall be used to fasten signs onto metal sign posts. To prevent vandalism, no nuts and bolts will be permitted to fasten any sign to metal sign posts. Galvanized washers shall be used behind all drive rivets used to affix signs to posts. Two drive rivets at right angles or angle bolts shall be used to fasten post to base.

#### Medium-Density Overlay

The medium-density overlay shall be a smooth, post saturated resin-fiber surface of Crezon II with a phenolic resin content of not less than 22 percent by weight. Each Crezon II sheet shall weigh not less than 58 pounds per 1,000 square feet of single-face. After application, the thickness of the material shall be not less than 0.012 inch. Panels shall have plugged "C" inner plies and shall be primed on the sign bearing surface with medium oil alkyd primer (buff).

#### Letter Spacing

Spacing between letters, words, numbers, and/or symbols shall be in conformance with the "Standard Alphabets for Highway Signs" manual.

#### Reflective or Non-Reflective Sheeting Application

Manufacturer's splices of sheeting will be permitted. Only one manufacturer's splice will be permitted per sign. No splices by the Contractor will be permitted.

On all other signs, if the reflective sheeting needs to be spliced, the splice(s) shall be horizontal with the upper section(s) of sheeting overlapping the lower by a minimum of

3/8 inch. Only one splice by either the manufacturer or contractor will be permitted per sign.

## **420 STREET NAME SIGNS**

In business districts and on major arterials, street name signs should be placed in diagonally opposite corners so that they will be on the right hand side of the intersection for traffic on the minor street. In residential districts, at least two sets of street name signs will be mounted at each intersection.

On T-intersections, the street name signs will be designated at two locations. One set of street name signs shall be placed at end of a "T" intersection, and the second set placed at the right hand corner of the intersecting street.

### **420.1 MATERIALS**

#### Aluminum

A street name sign shall be 6-inch high, flat, 0.100-inch thick aluminum. The minimum length is 24-inch and the maximum length is 36-inch. The corners shall have the standard 1/2-inch radius corners.

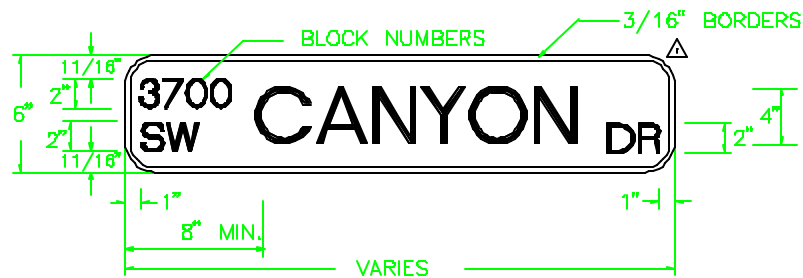
#### Sheeting

Both sides of street name signs shall be green 3M Scotchlite brand high intensity reflective sheeting. A 3/16 inch border shall be placed on each sign face.

#### Lettering

Street name signs consist of two sizes of 3M Scotchlite brand high intensity white letters on green background: 2-inch series "C" and 4-inch series "B". All block numbers shall be provided in 2-inch series "C". All letters shall be uppercase.

Example of City of Beaverton Street Name Sign:



|              |                   |
|--------------|-------------------|
| Installation | See Section 410.1 |
| Posts        | See Section 410.1 |
| Base         | See Section 410.1 |

## 430 TRAFFIC SIGNALS

## 430.1 DESIGN AND INSTALLATION REQUIREMENTS

Traffic signal installation shall conform with MUTCD and the Oregon State Department of Transportation Revisions.

Manuals to consider as text are:

1. MUTCD
2. Oregon Amendments
3. Standard Specifications for Highway Construction (ODOT)
4. Standard Specifications for Micro Computer signal controller (ODOT)
5. Standard Drawings for Design and Construction (ODOT)
6. Field Inspector's Manual for Signal Construction (ODOT)
7. State and National Electrical Code "Current Addition" Engineer to obtain copy of final electrical inspection from the contractor and submit it to the City along with his daily inspection reports.

## **430.2 DESIGN DRAWING REQUIREMENTS**

Traffic Signal installation plans shall consist of the following separate sheets:

1. Construction Plan (Street) 1-inch = 20 feet
2. Signal Wiring Including Electrical Service 1-inch = 20 feet
3. Underground Detection Plan 1-inch = 20 feet
4. Sign and Striping Plan 1-inch = 40 feet

## **430.3 MODIFICATION TO GENERAL SPECIFICATIONS**

Modification, or specific to general specifications are:

1. Specific micro processor EPROM program shall be W4IKS supplied with each controller, unless otherwise specified.
2. Opticom shall be installed on all approaches to signal and no opticom detector shall be installed on end of mast arms.
3. Traffic detection shall consist of pre-formed (State Spec) loops, as directed by the City Engineer or designee.
4. Detection wiring shall be extended to the cabinet for each local and advance field detector and by each lane.
5. Pedestrian fixture shall be international symbols only.
6. Traffic controller cabinet shall be anodized aluminum.
7. Traffic controller and cabinet shall be supplied pre-tested by the Oregon State Highway Department and complete with operation components and software.

## **430.4 FIELD WIRE TESTING**

1. All signal electrical wiring, including spares, shall pass a High Pot 2kV A.C. test before acceptance.

## 440 TRAFFIC MARKING

- Traffic marking shall follow the MUTCD and TCDH as revised by ODOT.
- Material specifications shall conform to ODOT standard specifications for construction.

### Materials

All thermoplastic material shall conform to State Specifications. All hot thermoplastic shall be alhyd based.

### Application

Existing surfacing which is to receive the thermoplastic material shall be mechanically wire brushed to remove all dirt and contaminants. Surfaces of new portland cement concrete pavement to receive the thermoplastic material shall be mechanically wire brushed or abrasive blast cleaned to remove all lattice and curing compound.

Existing pavement markers which are damaged by blast cleaning or wire brushing shall be removed and replaced by the Contractor at his expense.

Thermoplastic material shall be applied only to dry pavement surfaces and only when the pavement surface temperature is above 50 Degrees Fahrenheit.

A primer, of the type recommended by the manufacturer of the thermoplastic material, shall be applied to all asphaltic surfaces over six months old and to all portland cement concrete surfaces. The primer shall be applied immediately in advance of, but concurrent with, the application of thermoplastic material. The primer shall be applied at the application rate recommended by the manufacturer and shall not be thinned.

### Hot Thermoplastic Application

In addition to the applications listed above, the following shall apply to hot thermoplastic applications.

Preheaters with vertical mixers having 360 degree rotation shall be used to preheat granular form material.

The thermoplastic material shall be applied to the pavement at a temperature between 400 and 425 degrees Fahrenheit unless a different temperature is recommended by the manufacturer.

The thermoplastic material shall be applied by either spray or extrusion methods in a single uniform layer.

Stencils shall be used when applying thermoplastic material for pavement markings.

The pavement surface to which thermoplastic material is applied shall be completely coated by the material and the voids of the pavement surface shall be filled.

Unless otherwise specified in the special provisions, the thermoplastic material for traffic stripes shall be applied at a minimum thickness of 0.060-inch. Thermoplastic material for pavement markings shall be applied at a thickness of 0.100- to 0.150-inch. Glass beads shall be applied immediately to the surface of the molten thermoplastic material at a rate of not less than 8 pounds per 100 square feet. The amount of glass beads applied shall be measured by stabbing the glass bead tank with a calibrated rod.

1. Permanent marking shall consist of raised markers, cold or hot thermoplastic. The specific layout of which is to be approved by the City Engineer or designee.
2. Painting or foil back tape may be used for temporary marking.
3. Hot thermoplastic shall be used for all permanent marking installed on all concrete streets.
4. Cold thermoplastic 3M or equivalent tape rolled into the surface shall be used on new asphalt streets, including overlays.
5. Raised markers (reflectors and buttons) shall be used in conjunction with permanent marking layouts.
6. Approved striping material and layout shall be submitted to and approved by the Traffic Engineer prior to installation.
7. Policies for marking patterns are detailed in the TCDH and in the City Standard Drawings.

## 450 STREET ILLUMINATION

### 450.1 GENERAL DESIGN

All street lighting shall be designed using the Illuminating Engineering Society guidelines as modified in this manual. All street light poles should be located near property lines and at least 25 feet from any trees, unless otherwise pre-approved in writing by the Operations and Maintenance Director.

All electrical components shall be UL approved or approved equal and testing lab approved from labs accepted by the State of Oregon.

All street light plans shall include: pole locations, conduit locations, junction box locations, transformer/controller cabinet locations, photometrics (or P.E. Certification), along with any other pertinent information.

The contractor shall be responsible to provide all required traffic control.

The contractor shall be responsible for making arrangements with PGE for connecting the street lighting system to the local distribution system.

The following codes and references shall be used in designing all street light systems:

- a. State and National Electric Code (current edition). Engineer to obtain copy of final electrical inspection from the contractor and submit it to the City along with his daily inspection reports.
- b. An Information Guide for Street Lighting by AASHTO.
- c. Fundamentals of Traffic Engineering by the Institute of Transportation Studies (current edition).



## Lighting Levels: Average Maintained Illuminance on the Horizontal

| Minimum Average Maintained in Foot Candles |            |                      |             |
|--|------------|----------------------|-------------|
| Roadway Classification                     | Commercial | Intermediate         | Residential |
| Freeways                                   | 1.4        | 1.2                  | 1.0         |
| Arterials                                  | 2.0        | 1.4                  | 1.0         |
| Collectors                                 | 1.2        | 0.9                  | 0.6         |
| Neighborhood Routes                        | 1.2        | 0.9                  | 0.6         |
| Local Streets                              | 0.9        | 0.6                  | 0.5         |
| Private Streets                            | 0.6        | 0.5                  | 0.5         |
| Roadside Walk and Bikeways                 | 0.9        | 0.6                  | 0.5         |
| Other Pedestrian and Bicycleways           |            |                      |             |
|  |            | Average Foot Candles |             |
| Walk and Bikeways Distant From Roadways    |            | 0.5                  |             |
| Pedestrian Tunnels                         |            | 4.0                  |             |
| Pedestrian Overpasses                      |            | 0.5                  |             |
| Pedestrian Stairways                       |            | 0.6                  |             |

The minimum average uniformity of lighting shall be 6 to 1 for local streets and 3 to 1 for all other areas.

All street lights shall be option 'C' as defined below unless otherwise approved in writing by the Operations and Maintenance Director. The Operations and Maintenance Director shall approve all street illumination options (A, B, or C) with PGE prior to installation.

### 450.2 OPTION 'A' LIGHTING

Under this option, PGE will install, own, and maintain street lighting.

### 450.3 OPTION 'B' LIGHTING

Under this option, the developer will install the street lighting, the City shall own the poles and fixtures, and PGE will maintain it.

### 450.4 OPTION 'C' LIGHTING

Under this option, the developer will install the street lighting and the City of Beaverton will own and maintain it. The developer shall maintain the street lighting system during the maintenance period. A seven (7) day burn-in period is required prior to acceptance

into the maintenance period. All option 'C' lighting shall comply with the following requirements:

#### **450.4.1 CONDUIT**

All new installations and replacements of wire shall be in schedule 40 PVC or rigid metal conduit, which shall conform to the applicable requirements of Article 347 of the National Electrical Code. Any conduit which is prone to flooding (near a water source, within a floodplain, within an area of known flooding, or an area of high ground water) shall be installed per the "wet location" requirements of the NEC. Rigid conduit shall extend from the power source to a junction box which is to be located not more than three feet from each pole served. All conduit shall be marked using a "Warning Tape" which shall be located per industry standards. Junction boxes within sidewalk areas shall be concrete with cast metal covers held with tamper resistant fasteners and shall be stamped "Street Lighting". Any approved box (Brooks #36 or equal) may be used outside of sidewalk areas. Connections between the junction box and the lighting pole are to be by use of direct buried cable (only when using direct bury poles - otherwise conduit shall be required). Splices shall never be done within the conduit. All conduit shall have a burial depth of 36 to 42 inches below finished grade. Conduit size shall be a minimum of 1 inch. All conduit ends shall have terminal adapters and brushings installed. All conduit ends shall be sealed with "Molded Plug" performed foam conduit and pope seals or an approved equal. All conduit ends, with brushings installed, shall be between 4"-6" below the bottom of the junction box lid or be severely bent over the conduit ends. All conduit ends in junction boxes or foundations shall have a one inch clearance from other conduits, rods, pole walls, or j-box walls. Conduits shall enter through the bottom of the j-box with factory 90 degree ells. Conduit shall terminate near the box wall to leave the major portion of the box clear. Conduit outlets shall be located on the side of the box which corresponds to the direction of the conduit run, and shall be no closer than 4 inches from the bottom of the box lid and at least 2 inches above the gravel fill. Conduit ends shall be oriented towards the top of the box such that the conductors may be pulled out of the conduit from the top of the box without touching the side of the box.

#### **450.4.2 CABLE AND WIRE**

Circuits and Cable runs shall be designed to provide separate and independent circuits for street lights. Wire size shall be determined by the loading and distance of each circuit. Wire shall be sized to limit voltage drops to a maximum of 2% between the utility service connection and the control panel and a maximum of 3% from the control panel to the most distant fixture served. All voltage drop calculations shall be approved by the City Operations and Maintenance Director.

Solid aluminum or copper wiring shall not be used. All wire shall be stranded copper, single conductor, with a 600 volt insulation. The minimum wire size shall be #10 AWG stranded copper wire, type XHHW for the lighting circuit. The photocell circuit wires shall be #12 AWG stranded copper, type XHHW. The maximum wire size shall be #1 AWG stranded copper. Equipment ground wire shall be stranded copper, single conductor, either bare or with a 600 volt green insulation. Cable installation shall conform to the National Electric Code and the design standards of the City of Beaverton. All wire and cable splices and connections shall be made within approved junction boxes and shall be accomplished with approved fasteners. Any splices and connections which are prone to flooding (near a water source, within a floodplain, within an area of known flooding, or an area of high ground water) shall be installed per the "wet location" requirements of the NEC.

Wire insulation color shall conform to the following:

- a) 120 volt photo electric circuit wires shall be #12 AWG stranded copper wire, type XHHW. A yellow wire from the controller to the photo cell, purple wire for the return to the cabinet.
- b) 240 volt line distribution wires shall be a controller shall be a minimum of #10 AWG stranded copper wire, type XHHW. One wire shall be black in color, the other wire shall be red in color. When two or more separate circuits are run in the same conduit, the second pair of conductors shall be blue and brown. Additional colors for addition circuits may be required with the approval of the lead electrician.
- c) Grounded conductors shall be white.
- d) Grounding conductors shall be green insulated or bare stranded wire.

Color coding of each conductor shall remain consistent throughout the entire system. Factory supplied striping of conductors will be accepted when the required color insulation is not available. Color tape will not be accepted as an alternate for insulation color coding.

Electrical wire splices located in junction boxes, poles, or other similar locations shall be made moisture and water proof by using either a heat shrink tubing with pre-applied sealant or electrical insulating rubber tape overwrapped with electrical vinyl tape. Each splice shall be taped separately. If epoxy sealant bags are used to seal splices, each splice shall be sealed separately.

### **450.4.3 POLES**

Anchor base poles shall be used on arterial and collector streets. Direct bury poles shall be used in residential subdivisions unless otherwise pre-approved, on a case-by-case basis, by the Operations and Maintenance Director. Wood poles shall not be used.

#### Residential Streets

The standard pole for collector streets shall be "Whatley" pole, part no. A4225-07-58-N6/ Beaverton which requires a 14" bolt circle and a bolt size of 1"x36"x4" or approved equal. The standard pole for residential street shall be "Whatley" pole, part no. E4030-07-58-N6/ P.G.E. or approved equal. Poles shall be bronze in color and constructed of filament wound fiberglass. If the poles are to be located behind the sidewalk, an aluminum mast arm bronze in color and of sufficient length to locate the fixture over the roadway will be required. The standard length of the arm shall be 6 feet. If the pole is located next to the curb the standard length of mast arm shall be 8 inches.

All direct bury poles and pre-formed pole bases shall be back filled with ½ yard of compacted ¾"-0" crushed rock.

#### All Other Applications

All other applications shall be evaluated on a case by case basis.

#### Pole Access

All lighting poles shall be constructed with a nominal 2-1/2 inch by 5 inch hand hole placed at 4 feet above the ground line. In plan view, the hand hole shall be at 90 degrees from the mast arm or curb side of the pole. The hand hole shall be secured with a cast aluminum or galvanized steel cover painted to match the pole and held in place with a stainless steel tamper resistant set screw.

### **450.4.4 LIGHTING FIXTURES**

Lighting fixtures shall be of the rectilinear "shoe box" design with a flat lens, sharp cut-off optical system unless otherwise preapproved by the Operations and Maintenance Director. Lighting fixtures shall be of the same bronze finish as the poles and mast arms. The fixtures within residential areas shall have a grounded 100 watt 240 volt high pressure sodium light source. Mercury vapor lamps shall not be used. Fixtures within other areas shall be high pressure sodium of a wattage

that is necessary to achieve the required light level for the particular application. Fixtures shall be of the "power door" type with the electronic components mounted on a single removable panel that will facilitate dry room repairs or replacement. Lenses shall be mounted in a panel or door to facilitate one hand release for re-lamping and cleaning. All fixtures shall have a TYPE-III light distribution. When a photocell is installed on fixtures, a three pole twist-lock receptacle shall be used in conjunction with Fisher Pierce, model 7709B photocell, or equivalent.

All fixtures shall have a multi-tap ballast and be pre-connected to 240 volt taps. All circuits and fixtures shall be wired 240 volts. All fixtures shall be grounded. Every fixtures shall have numbers, visible from the street, indicating the wattage of the fixture. 10=100watts 15=150watts etc.

#### **450.4.5 CONTROLS**

Details of the street lighting controller cabinet shall be submitted to the Operations and Maintenance Director for approval prior to fabrication. Contact the Operations and Maintenance Street Lighting Section for the current controller cabinet specifications. The location and type of street light circuit controller shall be shown on all street lighting plans. Whenever possible, the controller cabinets shall be installed away from intersections. The cabinet shall have a service panel that has a "Service Equipment" rated UL label (or approved equal) attached to the panel. Each controller shall be painted light green and shall be placed on a concrete pad.

A 100 amp, single phase, 3 wire, 240 volt, dedicated unmetered service is to be provided by the developer. Each street lighting circuit shall be wired 240 volts. The street light controller shall be a "Circle AW catalog no. Cup 4111" or equivalent. The street light controller shall be mounted on a concrete pad with craft paper between the controller and the concrete pad. The concrete pad shall measure 24"x24"x18" deep. The anchor bolts shall be ½"x10" galvanized "J" bolts and shall be set with 1 ½" of threaded bolt above the finished concrete base. The concrete controller base shall be set at the sidewalk grade and located not more than 2 feet behind the sidewalk. The controller cabinet shall be sealed around the bottom with silicone seal or caulk. All street lights shall operate at 240 volts and shall be grounded.

All street light circuit shall be controlled by a single photocell installed on the street light fixture closest to the controller cabinet. Photocell shall be NEMA type twist lock with receptacle adjustable to point north. The photocell shall be used in conjunction with a lighting contactor in the controller cabinet.

All circuits shall have a manual on/off switch which will over-ride the photo-electric cell. This switch shall be located within the interior of the controller cabinet.

A fuse connection shall be made between the circuit and each light fixture on that circuit. All fusing of the hot leads shall be done in the pole with in-line fuse holders located as to be accessible through the hand hole. The fuse holder shall be a L-FSE LEB-AA fuse holder, a WPB-1 Insulated boot and a 250 volt midgit flm 5 fuse or equivalent. In systems with lights on both sides of the street, the circuitry shall be designed as such that the lights on one side of the street can be "de-energized" without affecting the operation of the lights on the other side of the street.

#### **450.4.6. JUNCTION BOXES**

All junction boxes shall be wire reinforced precast concrete type with cast iron or steel covers held with tamper resistant fasteners and shall be stamped "Street Lighting". Metal box covers shall be hot-dip galvanized after fabrication. Concrete or aluminum covers are not allowed. There shall be 1 junction box for each street light pole. The junction box shall be located not more than 3 feet from the pole that it serves. All junction boxes shall be set at finish grade or curb height, which ever applies. The minimum size and type of junction boxes shall be a Brooks #36, or equivalent. Use a larger size junction box where needed. The metal lids of the junction boxes shall be bonded. All junction boxes shall have a minimum 12" deep of 3/8"-0" pea gravel in the bottom of the junction box for water drainage. 3/4"-0" crushed rock is not acceptable for drainage. If mud or dirt has infiltrated into the junction box, remove all contaminated pea gravel and install new pea gravel. When conduit crosses a street, a junction box shall be set on each side of the street at the crossing. A junction box shall be set at each horizontal turn in the conduit of 45 degrees or more.

End of Chapter